GROUNDWATER RESOURCE REVIEW
MCLEOD HILL, YORK COUNTY, N.B.

May 1988

MGI

MARITIME GROUNDWATER INVESTIGATIONS INC.

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1.0 INTRODUCTION

In December, 1987 and January, 1988, a water resource study was completed in the McLeod Hill area of York County, New Brunswick. The objective of this study, commissioned by the Department of Municipal Affairs and Environment, was to complete a hydrogeological evaluation and in particular to document well yield and water quality problems in the Chateau Heights Subdivision on McLeod Hill.

The study area is located northwest of the City of Fredericton and includes local areas such as McLeod Hill, Royal Road and Kingsley Road. The eastern part of the study block is actually within the limits of the City of Fredericton.

2.0 GEOLOGY AND PHYSIOGRAPHY

The project area exhibits rolling hillsides and surface water drainage courses that commonly cut into the topography by 5 to 15 m. An exception to this is the cliff-like feature on the western side of McLeod Hill which exhibit topographic differences of 90 m over a horizontal distance of 250 m. An extensive flood plain is present in the Nashwaaksis Stream Valley from Estey's Bridge to a point where this stream discharges to the Saint John River. The valley throughout this part of the drainage basin has been filled with alluvium and/or glacial deposits. In the upper reaches of the Nashwaaksis Stream tributaries, numerous bog deposits are present where there is little topographical relief.

2.1 Surficial Geology

The surficial geology of the study area has been divided into six map-units by the Department of Energy, Mines and Resources (Plate 1). The western half and north central portion of the study area is covered by a veneer of stoney lodgement till. This morainal deposit, lying on bedrock, is generally discontinuous and less than 0.5 metres thick but thicknesses of up to 3 metres are known. The northeast corner of the study area is a morainal plain reflecting bedrock topography. The cover consists of a stoney ablation till, generally more than 1.5 metres thick. A number of northeast trending morainic ridges are present. The McLeod Hill area itself is covered by a stoney morainal blanket till generally 0.5 to 1.5 metres thick. The Nashwaaksis Stream floodplain and those of its East and West branches to a point approximately 2 kilometers upstream from their junction represent post-glacial valley terraces. These deposits consist of stoney alluvium, generally gravel and sandy gravel, the upper 0.5 to 1 metre usually consisting of silt and sandy silt. The western slope of McLeod Hill is covered by colluvium, weathered and disintegrated bedrock from the steep, upper slope of the hill. The lowland south and southwest of McLeod Hill in the extreme southeast map-unit of the study area is covered by an outwash blanket of glaciofluvial deposits. Sand, gravel and minor silt averaging between 0.5 and 1.5 metres cover the bedrock.

2.2 Bedrock Geology

The bulk of the study area is underlain by Pennsylvanian age rocks of the Pictou Group. Two exceptions exist, one in the southwest corner of the study area north of Currie Mountain and the other on the western half of McLeod Hill. In both these areas, Lower Pennsylvanian sediments and Mississippian sediments and volcanics are exposed.

The stratigraphic column for the study area is made up of three rock units (Plate I). The lowermost unit is the Mississippian/Pennsylvanian Unit, commonly referred to as the Hopewell Group. This unit is exposed along the north side of the Saint John River from Mactaquac to Fredericton where it consists of red siltstone, which is locally calcareous. Along the Carlisle Road, light grey lenticular caliche beds, up to 5.0 cm thick, are abundant in red siltstone and fine-grained red sandstone. The redbed sequence, exposed at these locations, is overlain by flows of basalt with the volcanic vent postulated to be Currie Mountain. Two separate sequences of volcanic flows have been observed, separated by approximately 15 to 20 metres of red sandstone. The one basalt flow observed at the abandoned quarry on the Royal Road is at least 25 metres thick. This exposure and the cliff face above the east side of the Royal Road form the western edge of McLeod Hill which is essentially capped by the basalt. The Forbes and Sloat Quarry on the Carlisle Road is located in one of the volcanic flow sequences, likely the upper one. The volcanics and associated

sediments exposed in the Forbes and Sloat Quarry, where fresh unweathered rock is readily observable, exhibit abundant secondary quartz and calcite mineralization.

The volcanics do not necessarily mark the top of the Mississippian/Pennsylvanian Unit. There is drill hole evidence, east of the study area, which indicates that approximately 50 metres of red coloured sandstone and siltstones can overlie the volcanics.

The Mississippian/Pennsylvanian Unit is overlain by the Pennsylvanian age Boss Point Formation, the latter being exposed on the Royal Road. At least 25 metres of strata are exposed although the top of the Formation is concealed. The exposure consists of normally graded quartz pebble conglomerate interbedded with medium to coarse-grained quartzose to lithic sandstone up to 2 metres in thickness. The pebbles are well-rounded and up to 12 centimeters in diameter; most, however, are 2.5 to 5 centimeters in diameter. The sandstone beds are trough cross-bedded with maximum trough thickness of 0.5 metres and bed thickness of 2 metres. The sequence of sandstone and conglomerate is repeated several times in outcrop with a thin, grey siltstone horizon locally present. An outcrop north of the Carlisle Road indicates that the base of the Boss Point usually contains chert, quartzite, abundant quartz and minor basic volcanic fragments of up to 20 centimeters in diameter. The upper contact with the overlying Pictou Group appears to be conformable and is at least gradational.

The Pennsylvanian age Pictou Group covers approximately one-third of New Brunswick. This rock unit covers the

eastern portion of the province bounded by Bathurst, Oromocto Lake and the Nova Scotia border. As previously indicated, the study area is in large part underlain by Pictou Group sediments. A typical Pictou sequence consists of sub-rounded to rounded polymictic conglomerate beds ranging from 5 centimeters to 2 metres in thickness. Randomly oriented plant debris, sometimes coalified, can be found in the conglomerate. A coarse to medium-grained sandstone, parallel laminated and up to 0.5 metres thick, may overlie the conglomerate. A cross-laminated, very fine to fine sandstone may overlie the trough cross-bedded sandstone. This sequence is repeated a multitude of times, often with one or more rock units missing at one location. Generally, but not necessarily, the very fine to fine grained sediments are red in colour whereas the coarser grained sediments are grey to grey-green in colour.

A drill hole cored near Penniac by Killarney Gas and Oil Limited and logged by the New Brunswick Department of Natural Resources in 1971, provides stratigraphic information for the study area. Obviously, the depths at which the various rock units were intersected will not apply to the study area but the general stratigraphy is applicable. Similarly, the unit thicknesses intersected will be useful in determining potential unit thicknesses for the study area. The generalized section represented by the drill hole is as follows:

Depth (metres)	Thickness (metres)	Predominant* Colour	Rock Unit
0 - 516	516	grey	Pictou Group
516 - 568	52	grey-white	Boss Point Formation
568 - 611	43	red	Miss./Penn. Unit Sediments
611 - 622	11	grey-black-red	Miss./Penn. Unit Volcanics
622 - 642	20	red	Miss./Penn. Unit Sediments
642 - 703	61	grey-black-red	Miss./Penn. Unit Volcanics
703 - 737	34	red	Miss./Penn. Unit Sediments
737 - 820	83	grey-black-red	Miss./Penn. Unit Volcanics
820 -1050	230	red & grey	Miss./Penn. Unit Sediments

* Apply with caution

The study area is affected by faulting. The major fault which marks the northwest boundary of the Pennsylvanian rocks southwest from Fredericton to Harvey, crosses the Saint John River and traverses the southeast corner of the study area. The northwest side of the fault, including McLeod Hill, is uplifted relative to the southeast side of the fault. A vertical displacement of approximately 600 metres can be measured between the volcanics which cap McLeod Hill and those that were intersected at 611 metres in K.G.O. Limited's drill hole at Penniac. In addition to this major fault, there is evidence that several other faults, albeit of lesser magnitude, affect the study area and the McLeod Hill area in particular. Two parallel east-northeast trending faults apparently bracket the Hill, one to the north and one to the south and a north-northwest trending fault parallels the western side of the Hill. The latter is likely the cause of the marked topographic expression of the western side of McLeod Hill.

The volcanics which are exposed along the height of land on the western side of McLeod Hill apparently dip towards the east beneath the developing residential subdivision on the Hill. The depth from surface to the volcanics may increase to the east, towards the major fault which effectively removes the volcanics from the near surface by down-faulting. No information concerning the attitude of the volcanics is available nor was it possible to obtain reliable strike and dip information given the snow cover. The interrelationship of the dip of the volcanics and the slope of the land, therefore, has not been examined but, if equal, the depth from surface to the volcanics will remain constant. This information could likely be assembled, if required, from the Water Well Driller's Reports. These reports appear to accurately identify the volcanics; using the recorded depths and a detailed topographic location map it would be possible to prepare an isopach map indicating depth to the volcanics over the area of the subdivision. Given a sufficient number of reasonably detailed reports, isopachs of other rock units could also be prepared.

The volcanics, as briefly indicated in the preceding geological discussion, are known to host abundant secondary silicon and calcium based minerals. The presence of these minerals as fracture, bedding plane and void fillings will negatively affect the permeability of the volcanics and associated rocks.

In summary, McLeod Hill lies at the west-southwest end of an east-northeast trending horst capped by an

easterly dipping sequence of volcanic flows. The volcanics are covered by apparently progressively increasing thicknesses (to the east) of Mississippian/Pennsylvanian redbeds, Pennsylvanian basal conglomerates, lithic sandstones and associated rocks. The inherent impermeability of the volcanics, the sealing effect of secondary quartz and calcite issuing from the volcanics and the association of fine red clay with the Mississippian/Pennsylvanian sediments would likely result in water supply problems for any wells drilled into the Mississippian/Pennsylvanian Unit. These problems are probably most acute in the western areas of the McLeod Hill subdivision where the redbeds and volcanics are closest to the surface. Although detailed data is not available, it is suspected that these problems become progressively less acute to the east as the thickness of Pennsylvanian sediments (Boss Point Formation and Pictou Group) over the redbeds and volcanics increases. The presence of Pennsylvanian sediments over the bulk of the study area suggests that water supply problems beyond the McLeod Hill area would be similar to those problems associated with these rock units elsewhere in the province. An exception could be the southwest corner of the study area, north of Currie Mountain and possibly in the Carlisle Road area where the Mississippian/Pennsylvanian Unit approaches the surface.

2.3 Hydrogeology

Domestic and light industrial water supplies are predominantly obtained from a heterogeneous fracture network in the underlying bedrock. Well yields in the study area will vary from one area to another but will ultimately depend on the distribution and density of interconnecting fractures. In areas underlain by Mississippian sediments and volcanics, many fractures or cracks in the rocks have been filled with secondary silica and calcite. This will reduce the void space and hence secondary permeability and inground storage. In those areas where the Mississippian rocks have been overlain by a thick sequence of Pennsylvanian age Boss Point Formation, there appears to be sufficient open fractures to provide for adequate storage from which water can be withdrawn. However, if insufficient water is found in the latter unit, there appears to be little hope of finding an adequate yield for domestic use in the volcanic and sediment unit.

In areas outside McLeod Hill, the Pictou Group rocks appear to be sufficiently fractured so that adequate water supplies can be obtained by drilling to depths of 50 to 80 m. In the Kingsley Road area, we noted several artesian flowing wells with discharges of up to 1.5 litre/sec. and along the Royal Road an experimental well at the Nashwaaksis Experimental Watershed Project has been flowing at about 15 litre/sec. for at least 15 years. The experimental well is situated in the Nashwaaksis Stream Valley and most probably intersects a fault zone within the Pictou

Group. A buried channel with approximately 30 m of sand, gravel, boulders and clay present in the Kingsley/Estey Bridge area does not appear to have good aquifer characteristics but no detailed drilling logs have been completed in the immediate area (personal communication with local drilling contractors). Testing will be required to establish the hydrogeological value of this structure.

The groundwater quality throughout the study area is generally acceptable with regards to health considerations but parameters such as iron, manganese, hardness and hydrogen sulphide do present some aesthetic problems. In particular, hardness, iron and manganese in the McLeod Hill area tend to exceed the recommended or suggested limits while along the Kingsley and Royal Roads, excessive concentrations of nuisance elements are less common, but nevertheless present in sufficient quantities to provide some hardship. Groundwater supplies in the Chateau Heights area can have all of the above problems rendering treatment necessary. There are, however, several supplies in the Chateau Heights area that have low total dissolved solids levels and hence do not require treatment. The available data is insufficient to draw conclusions regarding the identification of potential targets based on the common characteristics of these supplies.

3.0 SAMPLE COLLECTION

On December 12, 1987, water samples were collected in the project area for major anion, cation and metals determination (Plate I). At this time, 13 samples were collected along the Royal, Kingsley and McLeod Hill Roads and questionnaires were completed at each home. During the week of December 14th, 20 additional samples were collected from the Chateau Heights area and water resource questionnaires were distributed to all residents of the subdivision. Two samples were also collected from the Chateau Heights area for gross radioactivity and metal scan analysis. The gross radioactivity tests were completed by the Health Physics Laboratory of the New Brunswick Electric Power Commission and the metal scan tests were completed by Ocean Chem Labs of Dartmouth, Nova Scotia. All other samples were submitted to the Department of Municipal Affairs and Environment for testing.

4.0 WATER QUALITY

Water samples collected throughout the study area were analyzed for major ions as well as pH, alkalinity, turbidity and conductance. Several samples were collected from distribution systems where treatment, iron removal and/or softeners were operational. The results of these analyses cannot be used to determine percentage of water supplies with chemical quality problems but they do show that the equipment works reasonably well as in most cases the treated water quality meets the maximum acceptable limits.

The chemical results for samples collected along the Royal, Kingsley and McLeod Hill Roads show that only those samples collected from McLeod Hill had hardness which exceeded 150 mg/litre. The other samples (11) had hardness values ranging from 14 to 117 mg/litre. Iron was above the acceptable limit of 0.3 mg/litre in three or 23 percent of the samples while seven or 61.5 percent of the samples had manganese levels above the acceptable limit of 0.05 mg/litre. The sulphate levels range from less than 5 to 51 mg/litre and all other parameters were within the maximum acceptable limits set out by Health and Welfare Canada. Chemical results for the minerals listed above are presented in Table 1.

Groundwater quality from private wells in the Chateau Heights Subdivision exhibited a much higher total dissolved mineral content than that found along the Royal Road. The water hardness level ranges from 105 to 521 mg/litre and 80 percent of the samples exceed 150 mg/litre. Over 50 percent of the samples had a hardness content of over 200 mg/litre but the water has been tolerated by consumers. Minerals such as calcium and magnesium principally contribute to the hardness levels and in Chateau Heights the calcium appears to be dominant. This reflects the high concentration of calcite found in fractures in the volcanic/sediment sequence.

The iron and manganese levels in groundwater from Chateau Heights are anomalous. Approximately 44 percent of the samples had iron concentrations above the acceptable limit of 0.3 mg/litre. These levels

TABLE 1

WATER QUALITY MACLEOD HILL ROAD, ROYAL ROAD AND KINGSLEY ROAD

Sample	Location	pH	Hardness	Iron	Fe+Mn	Manganese	Sulphate
1	Kinglsey Rd.	8.20	61.0	L.05	.12	0.116	51
2	Kingsley Rd.	7.85	75.0	0.43	.76	0.33	8.2
3	Kingsley Rd.	7.53	76.0	0.89	.95	0.06	16.3
4	Kingsley Rd.	8.51	23.0	0.09	.23	0.14	6.4
5	Royal Rd.	7.71	1.0*	L.05	—	L.01	7.3
6	Royal Rd.	7.81	115.4	L.05	.27	0.27	6.7
7	Royal Rd.	7.86	75.6	L.05	.13	0.13	L5
8	McLeod Hill	7.42	176.9	0.25	1.51	1.26	10.6
9	McLeod Hill	7.79	117.0	1.10	1.19	0.02	30.0
10	Royal Road	7.81	57.6	L.05	0	L.01	64
11	Royal Road	8.21	73.0	L.05	0	L.01	29
12	Royal Rd./ McLeod Hill	7.48	173.9	0.32	.82	0.50	51.4
13	Royal Road	8.87	14.8	L.05	0	L.01	6.7

* Water treatment in system

range from less than 0.05 to 2.36 mg/litre. The level of manganese found in the samples ranged from less than 0.01 to 0.99 mg/litre and 77 percent of the samples were above the maximum acceptable limit of 0.05 mg/litre. Both the iron and manganese limits have been established by Health and Welfare Canada on the basis of aesthetics and not on health considerations.

A surprisingly high level of sulphate (SO_4) was found in many of the water samples from Chateau Heights. As sulphur is found in areas of volcanic activity in the form of various compounds, such as sulphide type minerals (sphalerite, pyrite) or elemental sulphur, an hypothesis to explain the presence of sulphate in groundwater can be put forward. The erosional process invariably releases the sulphur contained in sulphide minerals in the form of sulphite (SO_3), which will dissolve in groundwater. In a 60 m deep well of the Chateau Heights area, it is conceivable that the groundwater originates mostly from fractures located near the surface, say at a depth of 10 m. The sulphite (SO_3) dissolved in this groundwater may combine with an oxygen atom during the cascading of the water from the fracture at 10 m to the water table at 60 m. Sulphate ($SO_3 + O_2 > SO_4$) may then be detected in the well. In the conversion and during the aeration time frame hydrogen sulphide gas (H_2S) will be released. The hydrogen sulphide gas has been reported by numerous residents from the subdivision from its unique odour. Table 2 shows the concentrations of iron, manganese, hardness and sulphate found in the water samples collected from Chateau Heights.

All other parameters measured at the Environment Laboratory were within the recommended limits except for one sample which contained 7.8 mg/litre zinc. The acceptable limit is 5.0 mg/litre and it is based on aesthetic considerations. Several other samples contained low levels of copper and zinc and four samples had levels of lead that exceeded the objective concentration of 1 UG/litre. Lead levels of 6.6, 9.0, 3.7 and 3.1 UG/litre were observed but they are well below the maximum acceptable limit of 50 UG/litre.

The level of nitrate-nitrite was always below the maximum acceptable of 10 mg/litre but levels such as 0.58 and 1.27 mg/litre may suggest some septic contamination.

Water samples (2) collected for radioactivity testing show radioactivity levels below normal background levels. These samples were analyzed by the Health Physics Laboratory of the New Brunswick Electric Power Commission.

All chemical results are appended.

TABLE 2

WATER QUALITY CHATEAU HEIGHTS

Sample	pH	Hardness	Iron	Fe+Mn	Manganese	Sulphate
14	7.31	243	1.13	1.75	0.62	80
15	7.66	219	0.10	0.30	0.20	236
16	7.05	290	1.37	2.47	1.10	105
17	8.40	21	L.05	---	L.01	80
18	7.51	232	0.40	1.03	0.63	66
19	6.64	90	0.16	0.17	0.01	12
20 *	7.68	4.20	0.08	0.08	L.01	30
21	7.81	320	L.05	---	L.01	366
22	8.01	105	L.05	0.03	0.03	30.8
23	7.88	136	0.12	0.21	0.09	16.6
24	7.68	204	0.13	0.21	0.08	106
25	7.31	182	L.05	---	L.01	8.5
26	7.17	521	0.56	1.30	0.74	318
27	6.89	121	1.71	2.50	0.79	7.5
28	7.51	274	0.07	0.74	0.67	88
29	7.00	153	1.01	1.53	0.52	8.5
30	7.36	374	1.58	1.89	0.31	161
31	7.57	151	0.09	0.19	0.10	26
32	7.09	143	L.05	---	L.01	21
33	7.24	230	.05	1.04	0.99	117
34	7.41	323	2.36	3.07	0.71	102

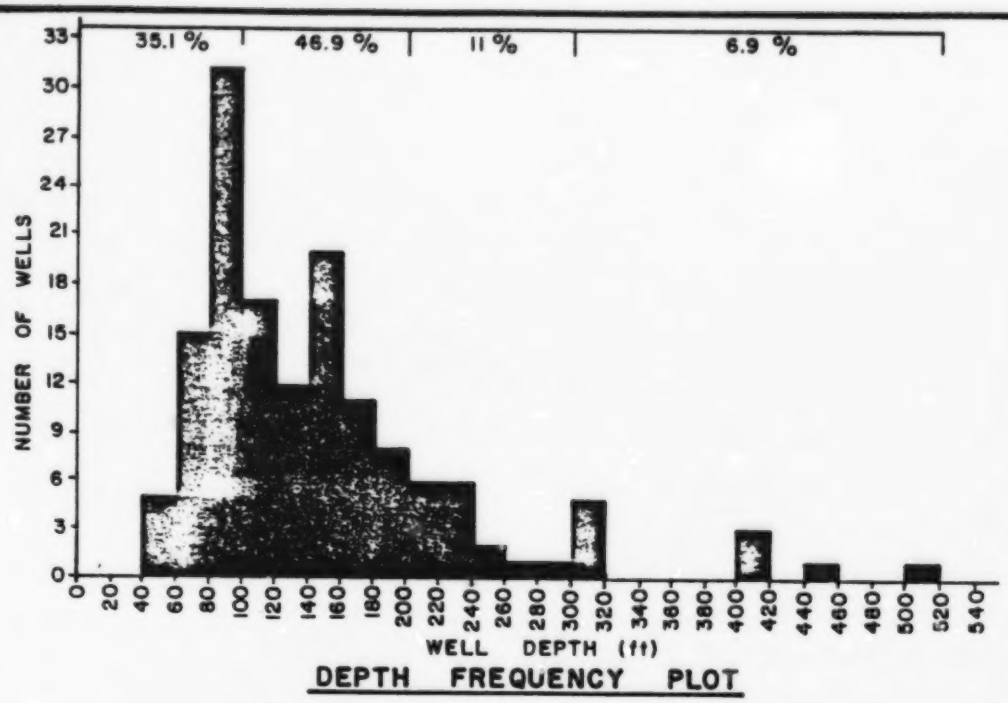
* Water treatment on system

5.0 WELL YIELD AND DEPTH REVIEW

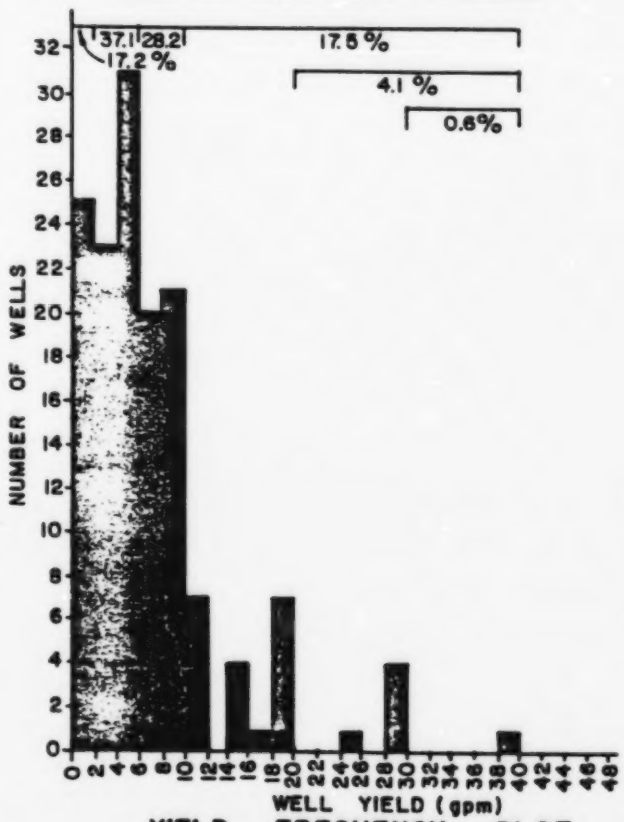
A review of drillers well log records filed with the Water Resources Planning Branch of the New Brunswick Department of Municipal Affairs and Environment was completed for the study area. The histograms on Figure 1 illustrate well depth and yield data for 145 wells in the entire study area while histograms on Figure 2 show similar data for wells constructed on McLeod Hill (including Chateau Heights).

In the entire study area, 17.2 percent of the wells had yields of less than 0.15 litre/sec (2gal/min), 65.3 percent had yields between 0.15 and 0.45 litre/sec (2 to 6 gal/min), and 17.5 percent had yields greater than 0.45 litre/sec (6 gal/min). Only 0.6 percent of the 145 well logs reviewed had a yield of greater than 2.27 litre/sec (30 gal/min). This data compares reasonably well with data obtained from 82 drillers reports on McLeod Hill. The yield frequency plot shows 20.7 percent of the wells had yields of less than 0.15 litre/sec (2 gal/min), 65.8 percent had yields between 0.15 and 0.45 litre/sec (2 to 6 gal/min) and 13.4 percent had yields greater than 0.45 litre/sec. Yields of greater than 2.27 litre/sec (30 gal/min) were only found in one of the 82 wells.

The front parts of both depth frequency plots are similar with only slight variations, but there are some differences for those wells greater than 91 m (300 feet). In the entire study area, 6.9 percent of the wells were deeper than 91 m (300 feet) while on McLeod

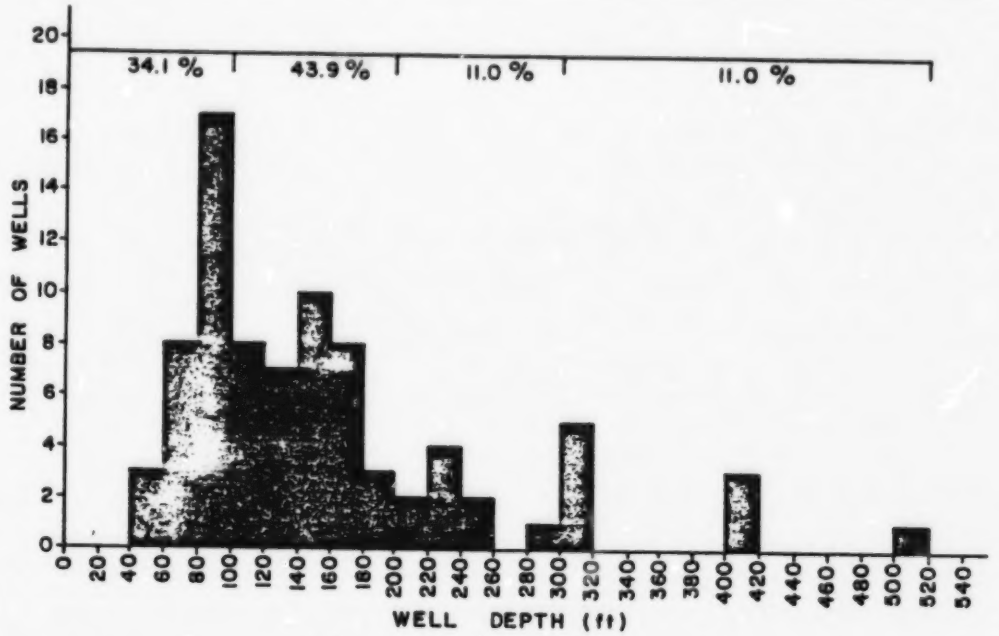


DEPTH FREQUENCY PLOT

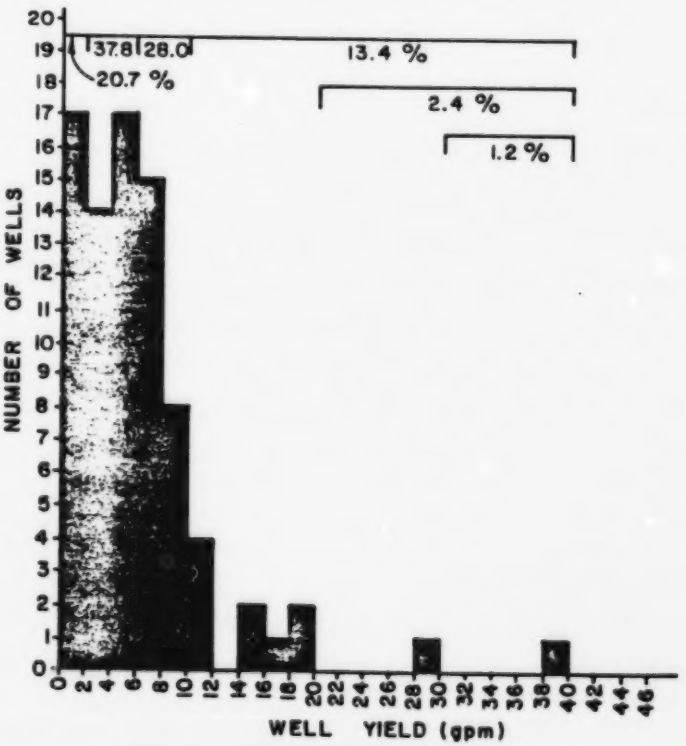


YIELD FREQUENCY PLOT

FIGURE 1 : WATER RESOURCE REVIEW - McLEOD HILL YIELD & DEPTH FREQUENCY PLOTS FOR ENTIRE STUDY AREA



DEPTH FREQUENCY PLOT



YIELD FREQUENCY PLOT

FIGURE 2 : WATER RESOURCE REVIEW – McLEOD HILL
YIELD & DEPTH FREQUENCY PLOTS FOR
McLEOD HILL / CHATEAU HEIGHTS

Hill, 10.9 percent of the wells were deeper. If the McLeod Hill wells which are greater than 91 m are excluded from the entire study area, then only 0.6 percent of the wells in the project area are greater than 91 m deep.

Previous works have shown that the quantity of water available via primary permeability in similar geological settings is low. The water available in an individual well most probably enters the well by fractures and the total amount available relates either to the distribution and density of fractures or to the proximity of the well to the fracture zone. Fracture density will vary from one location to another and in the study area the deeper wells and low yields on McLeod Hill may suggest that fracture density is lower than that found along Royal Road. However, because of the topography there is a low water table in some places in the Chateau Heights Subdivision. The fracture density in the top 60 m may be similar to that along the Royal Road but the openings are not water saturated. Local homeowners and well drillers have suggested that if water is found in the top 30 m, it will generally cascade to the water table near a depth of 60 m. In one situation the driller had to backfill the well to about 60 m below ground surface because he had intersected a fracture which drained all water found in the upper formation. The deeper wells on McLeod Hill therefore, may be directly related to topography and a low water table and/or differences in fracture density.

6.0 WATER RESOURCE QUESTIONNAIRE

Questionnaires were completed for each sample collection point outside Chateau Heights Subdivision and approximately 100 were distributed to residents of Chateau Heights.

Many of the homeowners on Kingsley and Royal Roads reported no problems with their water supply. Several suggested they had some plumbing fixture staining but the problems were not sufficient to make treatment necessary. Table 3 provides yield, well depths and water problem data found in the Chateau Heights Subdivision. This data was taken from the questionnaire.

A total of 80% of the questionnaires distributed to Chateau Heights residents were returned. Most of those that were returned cited problems such as lack of supply, 35 percent; hard water, 63 percent; water treatment on system, 49 percent; iron, manganese and hydrogen sulphide odour, 26 percent, while 26 percent reported that they did not have any problems. Several homeowners suggested they lost water when neighbours drilled a new well and one owner presently uses two wells to supply his domestic water needs. On the other hand, 16 percent of the owners that responded to the questionnaire reported yields of 0.75 litre/sec. (10 gal./min.) or more and 26 percent had yields of 0.375 litre/sec. (5 gal./min.) or more. The occurrence of both high yield and low yield domestic wells in a given

TABLE 3

WELL YIELD AND DEPTH, CHATEAU HEIGHTS

Location	Well Yield (Gal/Min.)	Well Depth (Feet)	Water Problems
Frontenac Drive	12	115	Hard water
Sunset Blvd.	<1	80	No water
	4	125	-----
	7	81	Lost water once
	3	200	Hard water
	1/2	400	Lack of water
	3/4	150	Lack of water
Sunset Blvd.	1	325	Lack of water
	1/2	450	Lack of water
Vista Lane	1/2	405	Lack of water
Frontenac Drive	5	158	Lack of water
	1/4	300	No problems
Crestline	10	103	-----
	4	160	-----
	12	102	-----
	10	140	-----
	4	150	-----
Chateau Drive	8	140	-----
	10	120	Hard water
	4	190	-----
	2	200	Hard water
	8	110	-----
	1.5	400	-----
	1.5	400	Fine sediment
Crestline	4	55	-----
	7	165	-----
	4	180	-----

Location	Well Yield (Gal/Min.)	Well Depth (Feet)	Water Problems
Crestline Dr.	1	185	-----
	4	220	Hard water
Chateau	6	120	No problem
	7	325	No problem
	2	200	No problem
	6	125	Minor hardness
	1	230	Hard water
Crestline Dr.	5	45	No problem
	4	205	
Frontenac Drive	3	180	
	4	185	
Frontenac Drive	3	180	Run out of water twice a week
Sunset Blvd.	1/4	605	No water
	1/2	305	Enough for home
	4	300	Slow recovery
	1	280	Sometimes lose water
	1/4	185	Used to have 2 1/2 gal./min.
	1/2	300	Not enough water
	1/2	400	
	1/2	300	Not enough water
	3	200	
	10	177	None
	10	205	None
	10	90	Little hardness
	20	180	Hard water
	30	160	
	15	80	None
	15	115	None

area reflects the importance of fracture density in finding large quantities of water.

In view of the above percentages, there are serious concerns regarding water supply and water quality problems in the Chateau Heights subdivision. When considering the geology of the area, these concerns appear to be well founded. A plot of the low yield wells, as shown on Plate 1, reveals that these problems occur sporadically throughout the subdivision and do not appear to be related to one specific rock unit. The water supply shortage compounds the quality problems, since these are usually treated with a back-wash cycle softener that necessitates a large amount of water. The potential for additional water supply problems caused by additional wells should be taken into account when approving new developments.

The water resource questionnaire is appended (Appendix B).

7.0 TECHNIQUES TO INCREASE WELL YIELD

Several techniques have been used in the past and in other areas to increase well yields. One of the most useful techniques is to have the drilling contractor develop or clean all fractures or soft sections in the well bore before proceeding to a greater depth. When this is not completed, drill cuttings may permanently block the low yield shallow fractures. In combination with the development or cleaning of fractures, the

contractor can also fill a low yield well (less than 60 m deep) with water and leave it overnight. The excess water will saturate the rock, and drill cuttings and/or fine formation material in the fractures will be removed when the contractor lifts the water from the hole.

A second method which may improve the yield of domestic wells in the study area is to employ a contractor who has equipment necessary to hydrofracture the well. During this procedure, water is pumped through a packer or seal placed in the rock. Pressures of up to 1.4×10^6 kilograms per square meter (2000 psi) are used to open small tight fractures in the rock surrounding the drill hole.

However, the hydrofracturing method should not be used in areas where the water table is 60 m below ground surface, as an increased flow out of the aquifer may be induced. In the Chateau Heights Subdivision, hydrofracturing should not be completed in wells where the formation is friable, or where there is insufficient cement in the rock. This is expected to compound the problem of wells filling with formation sediment. Hydrofracturing is expected to work reasonably well along the McLeod Hill Road as the rock is expected to be dense with a significant amount of quartz.

Homeowners who have a low yield well should consider drilling a second hole. Additional drill holes should

not be greater than 30 to 50 m as we expect the fracture density to decrease with depth.

The costs for completing additional works to increase the total amount of water or improve chemical quality available from low yield wells will depend on the technique and contractor/company employed. There are only one or two contractors who have equipment to hydrofracture wells and the cost will probably be equal to constructing a new well. Water treatment companies can provide estimated costs for specific methods to improve water quality, however, homeowners who have a low well yield may not be very interested in using treatment equipment that uses a backwash cycle as there is generally insufficient water for successful backwashing in some of the low yield wells.

Estimated costs for hydrofracturing will vary from site to site but should be less than $2,500.00 per well. There is no guarantee that this technique will increase well yield but this procedure has been successfully and extensively used throughout eastern United States. Drilling costs for constructing a second well are estimated to be in the range of $3,000.00. Actual costs will depend on the amount of casing used and the total depth of the well.

8.0 CONCLUSION

McLeod Hill lies at the west-southwest end of a horst, which is capped by an easterly dipping sequence of volcanic flows. These are overlain by progressively

increasing thicknesses of Mississippian/Pennsylvanian redbeds, Pennsylvanian basal conglomerates, lithic sandstones and associated rocks. The inherent impermeability of the volcanics, coupled with the filling of fractures with secondary quartz and calcite issuing from the volcanics and with the fine red clays associated with the Mississippian/Pennsylvanian sediments, would probably result in low yield wells drilled in the Mississippian/Pennsylvanian Unit. These problems are progressively less acute to the east of the study area where the thickness of Pennsylvanian sediments overlying the redbeds and volcanics increases.

The groundwater quality in the area is generally acceptable with regards to health considerations, but aesthetic problems associated with high concentrations of hardness, iron and manganese have been identified in the McLeod Hill and Chateau Heights areas and to a lesser degree, along the Kingsley and Royal Roads. Sulphate levels were also anomously high in the Chateau Heights area and are attributed to the conversion of sulphite to sulphate during the cascading of the groundwater in deeper wells.

A review of drillers well log records for the entire study area and the McLeod Hill area in particular, revealed that well depths and yields are similar in both regions. However, there is a greater concentration of deep wells, greater than 91 m in depth, in the McLeod Hill area. These may be directly

related to topography and a low water table and/or differences in fracture density.

A water resource questionnaire distributed to the homeowners of the Chateau Heights area revealed concerns regarding water supply shortages (35 percent) and hard water (63 percent). A respondent rate of 80 percent suggests that these results are reasonably accurate. Supervision of well drilling, particularly during the early phases may have detected a potential water supply problem, which could have been communicated to the appropriate department in order to limit further development phases.

Techniques to increase well yields include development and cleaning of fractures and soft sections prior to drilling to great depths. Hydrofracturing of existing wells may present another option.

9.0 RECOMMENDATIONS

1. It is recommended that further subdivision development (beyond those presently approved in the immediate area of the Chateau Heights Subdivision) not be approved unless it can be adequately shown that there will be sufficient water for domestic use. New subdivisions in these areas underlain by Mississippian volcanic rocks should not be approved unless the local stratigraphy is assessed.

2. It is recommended that homeowners with low yield wells attempt to increase their total water supply by drilling a second well or by hydrofracturing their existing well. Hydrofracturing should not be attempted when the water table is greater than 60 m below ground surface or along the Sunset Blvd. or along Crestline Drive. Prior to completing such works, professional staff from the Water Resource Planning Branch should be available to review available data and assist the homeowner.

3. It is recommended that the Department of Municipal Affairs and Environment provide sufficient funding to demonstrate and/or investigate the usefulness of hydrofracturing in the Chateau Heights Subdivision. Hydrofracturing should be demonstrated in at least two wells.

4. It is recommended that personnel from the Water Resource Planning Branch initiate discussions with mortgage or lending agency firms regarding the need to develop or identify domestic water source(s) prior to receiving funds to begin building.

5. It is recommended that the Department of Municipal Affairs and Environment and the Department of Health require extensive investigation prior to approving subdivision plans for housing developments. Test drilling must be completed to determine water quality and yield estimates if no local information is available. Data from the initial subdivision phase(s) must be evaluated thoroughly prior to permitting the developer to proceed with additional development. In addition, increases in inspection services, i.e. well drilling inspection, could be required in order to gather sufficient data for evaluation by the Planning Branch prior to permitting the developer to proceed with additional subdivision phases.

6. It is recommended that drillers complete detailed drilling record logs when constructing wells in the McLeod Hill area and other areas where low yield wells are anticipated. Drilling contractors should contact the Water Resource Planning Branch of Municipal Affairs and Environment for technical assistance when they encounter low yield wells.

APPENDIX A

CHEMICAL ANALYSES

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE

DATE: 12 / 12 / 87
TIME: 0720 hours

FIELD NUMBER: 938705471

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.848	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	163.9	MG/L	30 TO 500	MG/L
TURBIDITY	3.8	NTU	5.0	NTU
CONDUCTIVITY	425.	US/CM		US/CM
=TDS AS RESIDUE	330.267	MG/L		
=HARD AS CACO3	75.067	MG/L	200.	MG/L
CALCIUM AS CA	25.1	MG/L	200.	MG/L
MAGNESIUM AS MG	3.01	MG/L	150.	MG/L
SODIUM AS NA	60.4	MG/L	270.	MG/L
POTASSIUM AS K	1.52	MG/L		MG/L
CHLORIDE AS CL	32.2	MG/L	250.	MG/L
SULFATE AS SO4	8.2	MG/L	500.	MG/L
FLUORIDE AS F	.50	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	*.434	MG/L	0.3	MG/L
MANGANESE AS MN	*.331	MG/L	0.05	MG/L
COPPER AS CU	.014	MG/L	1.0	MG/L
ZINC AS ZN	.126	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: DM

PROP NAME:
DOMESTIC WATER SUP PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
Z

LAB NO: 9205G

FIELD NUMBER:
938705471

DATE DUE: 87 12 23
DATE REC: 87 12 14
DATE FWD: 87 12 23

DAYS TURNAROUND:
7

REMARKS: Sample #2

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE

DATE: 12/12/87
TIME: 0900 hours

FIELD NUMBER: 938705470

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	8.195	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	182.4	MG/L	30 TO 500	MG/L
TURBIDITY	.7	NTU	5.0	NTU
CONDUCTIVITY	506.	US/CM		US/CM
*TDS AS RESIDUE	392.089	MG/L		
*HARD AS CACO3	61.484	MG/L	200.	MG/L
CALCIUM AS CA	20.6	MG/L	200.	MG/L
MAGNESIUM AS MG	2.44	MG/L	150.	MG/L
SODIUM AS NA	83.7	MG/L	270.	MG/L
POTASSIUM AS K	1.36	MG/L		MG/L
CHLORIDE AS CL	10.6	MG/L	250.	MG/L
SULFATE AS SO4	51.	MG/L	500.	MG/L
FLUORIDE AS F	.68	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	L.05	MG/L	0.3	MG/L
MANGANESE AS MN	*.116	MG/L	0.05	MG/L
COPPER AS CU	.018	MG/L	1.0	MG/L
ZINC AS ZN	.030	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: DM

PROP NAME:
DOMESTIC WATER SUPPLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
1

LAB NO: 92040

FIELD NUMBER:
938705470

DATE DUE: 87 12 23
DATE REC: 87 12 14
DATE FWD: 87 12 23

DAYS TURNAROUND:
7

REMARKS: Sample #1

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE

DATE: 12/12/87
TIME: 1000 hours

FIELD NUMBER: 938705472

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.532	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	108.0	MG/L	30 TO 500	MG/L
TURBIDITY	.2	NTU	5.0	NTU
CONDUCTIVITY	239.	US/CM		US/CM
*TDS AS RESIDUE	202.636	MG/L		
*HARD AS CACO3	76.729	MG/L	200.	MG/L
CALCIUM AS CA	27.2	MG/L	200.	MG/L
MAGNESIUM AS MG	2.14	MG/L	150.	MG/L
SODIUM AS NA	19.3	MG/L	270.	MG/L
POTASSIUM AS K	1.00	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	16.3	MG/L	500.	MG/L
FLUORIDE AS F	.32	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	.089	MG/L	0.3	MG/L
MANGANESE AS MN	*.067	MG/L	0.05	MG/L
COPPER AS CU	.029	MG/L	1.0	MG/L
ZINC AS ZN	.036	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: DM

PROP NAME:
DOMESTIC WATER SUPPLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
Z

LAB NO: 9206Q

FIELD NUMBER:
938705472

DATE DUE: 87 12 28
DATE REC: 87 12 14
DATE FWD: 87 12 23

DAYS TURNAROUND:
7

REMARKS: Sample #3

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE

DATE: 12/12/87
TIME: 1030 hours

FIELD NUMBER: 938705473

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	*8.514	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	204.0	MG/L	30 TO 500	MG/L
TURBIDITY	.9	NTU	5.0	NTU
CONDUCTIVITY	400.	US/CM		US/CM
=HARD AS CACO3	23.501	MG/L	200.	MG/L
CALCIUM AS CA	7.88	MG/L	200.	MG/L
MAGNESIUM AS MG	.929	MG/L	150.	MG/L
SODIUM AS NA	81.0	MG/L	270.	MG/L
POTASSIUM AS K	.704	MG/L		MG/L
CHLORIDE AS CL	8.3	MG/L	250.	MG/L
SULFATE AS SO4	6.4	MG/L	500.	MG/L
FLUORIDE AS F	.71	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	.099	MG/L	0.3	MG/L
MANGANESE AS MN	*.149	MG/L	0.05	MG/L
COPPER AS CU	.058	MG/L	1.0	MG/L
ZINC AS ZN	.036	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: DM

PROP NAME:
DOMESTIC WATER SUPPLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
2

LAB NO: 92076

FIELD NUMBER:
938705473

DATE DUE: 87 12 28
DATE REC: 87 12 14
DATE FWD: 87 12 23

DAYS TURNAROUND:
7

REMARKS: Sample #4

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE

DATE: 12/12/87
TIME: 1100hours

FIELD NUMBER: 938705474

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.711	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	117.9	MG/L	30 TO 500	MG/L
TURBIDITY	.3	NTU	5.0	NTU
CONDUCTIVITY	243.	US/CM		US/CM
=TDS AS RESIDUE	214.159	MG/L		
=HARD AS CACO3	1.005	MG/L	200.	MG/L
CALCIUM AS CA	.32	MG/L	200.	MG/L
MAGNESIUM AS MG	L.05	MG/L	150.	MG/L
SODIUM AS NA	57.5	MG/L	270.	MG/L
POTASSIUM AS K	.225	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	7.3	MG/L	500.	MG/L
FLUORIDE AS F	.44	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	L.05	MG/L	0.3	MG/L
MANGANESE AS MN	L.01	MG/L	0.05	MG/L
COPPER AS CU	.082	MG/L	1.0	MG/L
ZINC AS ZN	.046	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: DM

PROP NAME:
DOMESTIC WATER SUPPLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
Z

LAB NO: 92080

FIELD NUMBER:
938705474

DATE DUE: 87 12 23
DATE REC: 87 12 14
DATE FWD: 87 12 23

DAYS TURNAROUND:
7

REMARKS: Sample #5

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE

DATE: 12/12/87
TIME: 11:00 hours

FIELD NUMBER: 938705475

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.814	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	115.4	MG/L	30 TO 500	MG/L
TURBIDITY	.2	NTU	5.0	NTU
CONDUCTIVITY	290.	US/CM		US/CM
*TDS AS RESIDUE	218.587	MG/L		
*HARD AS CACO3	115.455	MG/L	200.	MG/L
CALCIUM AS CA	37.4	MG/L	200.	MG/L
MAGNESIUM AS MG	5.36	MG/L	150.	MG/L
SODIUM AS NA	11.0	MG/L	270.	MG/L
POTASSIUM AS K	1.41	MG/L		MG/L
CHLORIDE AS CL	16.0	MG/L	250.	MG/L
SULFATE AS SO4	6.7	MG/L	500.	MG/L
FLUORIDE AS F	.39	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	L.05	MG/L	0.3	MG/L
MANGANESE AS MN	*.270	MG/L	0.05	MG/L
COPPER AS CU	L.01	MG/L	1.0	MG/L
ZINC AS ZN	.052	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: DM

PROP NAME:
DOMESTIC WATER SUP PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
Z

LAB NO: 9209G

FIELD NUMBER:
938705475

DATE DUE: 87 12 23
DATE REC: 87 12 14
DATE FWD: 87 12 23

DAYS TURNAROUND:
7

REMARKS: Sample #6

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE

DATE: 12 / 12 / 87
TIME: 1200 hours

FIELD NUMBER: 938705476

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.855	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	89.54	MG/L	30 TO 500	MG/L
TURBIDITY	.1	NTU	5.0	NTU
CONDUCTIVITY	205.	US/CM		US/CM
*TDS AS RESIDUE	159.913	MG/L		
*HARD AS CACO3	75.649	MG/L	200.	MG/L
CALCIUM AS CA	25.3	MG/L	200.	MG/L
MAGNESIUM AS MG	3.03	MG/L	150.	MG/L
SODIUM AS NA	9.42	MG/L	270.	MG/L
POTASSIUM AS K	1.37	MG/L		MG/L
CHLORIDE AS CL	6.6	MG/L	250.	MG/L
SULFATE AS SO4	L5.	MG/L	500.	MG/L
FLUORIDE AS F	.34	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	L.05	MG/L	0.3	MG/L
MANGANESE AS MN	*.134	MG/L	0.05	MG/L
COPPER AS CU	.020	MG/L	1.0	MG/L
ZINC AS ZN	.067	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: DM

PROP NAME:
DOMESTIC WATER SUP PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
1

LAB NO: 92100

FIELD NUMBER:
938705476

DATE DUE: 87 12 23
DATE REC: 87 12 14
DATE FWD: 87 12 23

DAYS TURNAROUND:
7

REMARKS: Sample #7

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE

DATE: 12 / 12 / 87
TIME: 12:0 hours

FIELD NUMBER: 938705477

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.420	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	185.4	MG/L	30 TO 500	MG/L
TURBIDITY	3.0	NTU	5.0	NTU
CONDUCTIVITY	436.	US/CM		US/CM
=TDS AS RESIDUE	336.866	MG/L		
=HARD AS CACO3	176.906	MG/L	200.	MG/L
CALCIUM AS CA	53.7	MG/L	200.	MG/L
MAGNESIUM AS MG	10.4	MG/L	150.	MG/L
SODIUM AS NA	11.7	MG/L	270.	MG/L
POTASSIUM AS K	3.62	MG/L		MG/L
CHLORIDE AS CL	20.8	MG/L	250.	MG/L
SULFATE AS SO4	10.6	MG/L	500.	MG/L
FLUORIDE AS F	.34	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	.253	MG/L	0.3	MG/L
MANGANESE AS MN	•1.26	MG/L	0.05	MG/L
COPPER AS CU	L.01	MG/L	1.0	MG/L
ZINC AS ZN	.047	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: DM

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
2

LAB NO: 92110

FIELD NUMBER:
938705477

DATE DUE: 87 12 28
DATE REC: 87 12 14
DATE FWD: 87 12 28

DAYS TURNAROUND:
7

REMARKS: Sample # 8

• INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE

DATE: 12/12/87
TIME: 1300 hours

FIELD NUMBER: 938705470

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.790	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	144.0	MG/L	30 TO 500	MG/L
TURBIDITY	*14.7	NTU	5.0	NTU
CONDUCTIVITY	329.	US/CM		US/CM
=TDS AS RESIDUE	277.72	MG/L		
=HARD AS CACO3	117.08	MG/L	200.	MG/L
CALCIUM AS CA	41.2	MG/L	200.	MG/L
MAGNESIUM AS MG	3.45	MG/L	150.	MG/L
SODIUM AS NA	19.9	MG/L	270.	MG/L
POTASSIUM AS K	1.66	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	30.0	MG/L	500.	MG/L
FLUORIDE AS F	.33	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	.22	MG/L	10.	MG/L
IRON AS FE	*1.10	MG/L	0.3	MG/L
MANGANESE AS MN	.024	MG/L	0.05	MG/L
COPPER AS CU	.881	MG/L	1.0	MG/L
ZINC AS ZN	2.56	MG/L	5.0	MG/L
PB-GF	26.7	UG/L		

PROP NO: 102
EVENT NO: DM

PROP NAME:
DOMESTIC WATER SUPPLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
Z

LAB NO: 92120

FIELD NUMBER:
938705470

DATE DUE: 87 12 23
DATE REC: 87 12 14
DATE FWD: 87 12 23

DAYS TURNAROUND:
7

REMARKS: Sample #9

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE

DATE: 12/12/87
TIME: 1230 hours

FIELD NUMBER: 938705479

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE CONCENTRATION LIMITS	MAXIMUM ACCEPTABLE UNITS
PH	7.809	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	71.36	MG/L	30 TO 500	MG/L
TURBIDITY	.3	NTU	5.0	NTU
CONDUCTIVITY	349.	US/CM		US/CM
=TDS AS RESIDUE	236.451	MG/L		
=HARD AS CACO3	57.641	MG/L	200.	MG/L
CALCIUM AS CA	17.0	MG/L	200.	MG/L
MAGNESIUM AS MG	3.69	MG/L	150.	MG/L
SODIUM AS NA	44.9	MG/L	270.	MG/L
POTASSIUM AS K	.029	MG/L		MG/L
CHLORIDE AS CL	18.2	MG/L	250.	MG/L
SULFATE AS SO4	64.8	MG/L	500.	MG/L
FLUORIDE AS F	.33	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	L.05	MG/L	0.3	MG/L
MANGANESE AS MN	L.01	MG/L	0.05	MG/L
COPPER AS CU	L.01	MG/L	1.0	MG/L
ZINC AS ZN	.172	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: DM

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
Z

LAB NO: 92130

FIELD NUMBER:
938705479

DATE DUE: 87 12 23
DATE REC: 87 12 14
DATE FWD: 87 12 23

DAYS TURNAROUND:
7

REMARKS: Sample #10

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE

DATE: 12 12 87
TIME: 1400 hours

FIELD NUMBER: 938705480

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	8.208	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	138.4	MG/L	30 TO 500	MG/L
TURBIDITY	.6	NTU	5.0	NTU
CONDUCTIVITY	301.	US/CM		US/CM
=TDS AS RESIDUE	263.083	MG/L		
=HARD AS CACO3	73.018	MG/L	200.	MG/L
CALCIUM AS CA	14.7	MG/L	200.	MG/L
MAGNESIUM AS MG	8.82	MG/L	150.	MG/L
SODIUM AS NA	35.5	MG/L	270.	MG/L
POTASSIUM AS K	1.01	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	29.3	MG/L	500.	MG/L
FLUORIDE AS F	.36	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	L.05	MG/L	0.3	MG/L
MANGANESE AS MN	L.01	MG/L	0.05	MG/L
COPPER AS CU	.019	MG/L	1.0	MG/L
ZINC AS ZN	.052	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: DM

PROP NAME:
DOMESTIC WATER SUPPLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
Z

LAB NO: 92140

FIELD NUMBER:
938705480

DATE DUE: 87 12 28
DATE REC: 87 12 14
DATE FWD: 87 12 23

DAYS TURNAROUND:
7

REMARKS: Sample #11

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #.

DATE: 12/12/87
TIME: 1430 hours

FIELD NUMBER: 938705481

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.747	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	220.1	MG/L	30 TO 500	MG/L
TURBIDITY	4.7	NTU	5.0	NTU
CONDUCTIVITY	483.	US/CM		US/CM
*TDS AS RESIDUE	423.955	MG/L		
*HARD AS CACO3	173.946	MG/L	200.	MG/L
CALCIUM AS CA	60.0	MG/L	200.	MG/L
MAGNESIUM AS MG	5.86	MG/L	150.	MG/L
SODIUM AS NA	32.3	MG/L	270.	MG/L
POTASSIUM AS K	1.05	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	51.4	MG/L	500.	MG/L
FLUORIDE AS F	.29	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	*.324	MG/L	0.3	MG/L
MANGANESE AS MN	*.504	MG/L	0.05	MG/L
COPPER AS CU	.018	MG/L	1.0	MG/L
ZINC AS ZN	.110	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: DM

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
Z

LAB NO: 92150

FIELD NUMBER:
938705481

DATE DUE: 87 12 28
DATE REC: 87 12 14
DATE FWD: 87 12 28

DAYS TURNAROUND:
7

REMARKS: Sample #12

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16/12/87
TIME: 0900 hours

FIELD NUMBER: 938705506

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	*8.866	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	216.9	MG/L	30 TO 500	MG/L
TURBIDITY	.3	NTU	5.0	NTU
CONDUCTIVITY	437.	US/CM		US/CM
=TDS AS RESIDUE	274.675	MG/L		
=HARD AS CACO3	14.803	MG/L	200.	MG/L
CALCIUM AS CA	5.02	MG/L	200.	MG/L
MAGNESIUM AS MG	.551	MG/L	150.	MG/L
SODIUM AS NA	6.30	MG/L	270.	MG/L
POTASSIUM AS K	1.12	MG/L		MG/L
CHLORIDE AS CL	13.1	MG/L	250.	MG/L
SULFATE AS SO4	6.7	MG/L	500.	MG/L
FLUORIDE AS F	.83	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	.02	MG/L	10.	MG/L
IRON AS FE	L.05	MG/L	0.3	MG/L
MANGANESE AS MN	L.01	MG/L	0.05	MG/L
COPPER AS CU	.013	MG/L	1.0	MG/L
ZINC AS ZN	L.01	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		
ALKALINITY,PHENOL AS CACO3	9.272	MG/L		MG/L

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
Z..

LAB NO: 150

FIELD NUMBER:
938705506

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #13

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE:
TIME:

FIELD NUMBER: 938705507

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.306	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	201.3	MG/L	30 TO 500	MG/L
TURBIDITY	*9.6	NTU	5.0	NTU
CONDUCTIVITY	510.	US/CM		US/CM
=TDS AS RESIDUE	443.409	MG/L		
=HARD AS CACO3	*243.853	MG/L	200.	MG/L
CALCIUM AS CA	84.6	MG/L	200.	MG/L
MAGNESIUM AS MG	7.92	MG/L	150.	MG/L
SODIUM AS NA	6.24	MG/L	270.	MG/L
POTASSIUM AS K	4.22	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	90.	MG/L	500.	MG/L
FLUORIDE AS F	.14	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	.01	MG/L	10.	MG/L
IRON AS FE	*1.13	MG/L	0.3	MG/L
MANGANESE AS MN	*.628	MG/L	0.05	MG/L
COPPER AS CU	.036	MG/L	1.0	MG/L
ZINC AS ZN	.216	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
Z

LAB NO: 160

FIELD NUMBER:
938705507

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #14

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16/12/87
TIME: 1230 hours

FIELD NUMBER: 938705513

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.677	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	184.5	MG/L	30 TO 500	MG/L
TURBIDITY	.4	NTU	5.0	NTU
CONDUCTIVITY	410.	US/CM		US/CM
*TDS AS RESIDUE	355.176	MG/L		
*HARD AS CACO3	4.199	MG/L	200.	MG/L
CALCIUM AS CA	1.52	MG/L	200.	MG/L
MAGNESIUM AS MG	.098	MG/L	150.	MG/L
SODIUM AS NA	91.0	MG/L	270.	MG/L
POTASSIUM AS K	.220	MG/L		MG/L
CHLORIDE AS CL	6.7	MG/L	250.	MG/L
SULFATE AS SO4	30.6	MG/L	500.	MG/L
FLUORIDE AS F	.10	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	.03	MG/L	10.	MG/L
IRON AS FE	.081	MG/L	0.3	MG/L
MANGANESE AS MN	L.01	MG/L	0.05	MG/L
COPPER AS CU	.031	MG/L	1.0	MG/L
ZINC AS ZN	.010	MG/L	5.0	MG/L
PB-GF	3.1	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:

LAB NO: 22G

FIELD NUMBER:
938705513

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #20

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16 /12 /87
TIME: 1200 hours

FIELD NUMBER: 938705512

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	6.643	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	31.94	MG/L	30 TO 500	MG/L
TURBIDITY	.8	NTU	5.0	NTU
CONDUCTIVITY	567.	US/CM		US/CM
*TDS AS RESIDUE	279.112	MG/L		
*HARD AS CACO3	90.32	MG/L	200.	MG/L
CALCIUM AS CA	27.4	MG/L	200.	MG/L
MAGNESIUM AS MG	5.32	MG/L	150.	MG/L
SODIUM AS NA	63.7	MG/L	270.	MG/L
POTASSIUM AS K	1.34	MG/L		MG/L
CHLORIDE AS CL	121.9	MG/L	250.	MG/L
SULFATE AS SO4	12.1	MG/L	500.	MG/L
FLUORIDE AS F	L.10	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	1.9	MG/L	10.	MG/L
IRON AS FE	.162	MG/L	0.3	MG/L
MANGANESE AS MN	L.01	MG/L	0.05	MG/L
COPPER AS CU	.878	MG/L	1.0	MG/L
ZINC AS ZN	.091	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		
NITRITE AS N	L.01	MG/L	1.0	MG/L

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
-

LAB NO: 21G

FIELD NUMBER:
938705512

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #19

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16 / 12 / 87
TIME: 1130 hours

FIELD NUMBER: 938705511

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.508	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	222.1	MG/L	30 TO 500	MG/L
TURBIDITY	1.2	NTU	5.0	NTU
CONDUCTIVITY	511.	US/CM		US/CM
=TDS AS RESIDUE	444.243	MG/L		
=HARD AS CACO3	*232.789	MG/L	200.	MG/L
CALCIUM AS CA	80.4	MG/L	200.	MG/L
MAGNESIUM AS MG	7.78	MG/L	150.	MG/L
SODIUM AS NA	9.34	MG/L	270.	MG/L
POTASSIUM AS K	4.94	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	66.	MG/L	500.	MG/L
FLUORIDE AS F	.11	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	*.403	MG/L	0.3	MG/L
MANGANESE AS MN	*.631	MG/L	0.05	MG/L
COPPER AS CU	L.01	MG/L	1.0	MG/L
ZINC AS ZN	L.01	MG/L	5.0	MG/L
PB-GF	9.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
I

LAB NO: 20G

FIELD NUMBER:
938705511

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #13

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 10 / 12 / 87
TIME: 1100 hours

FIELD NUMBER: 938705510

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	8.402	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	180.3	MG/L	30 TO 500	MG/L
TURBIDITY	.3	NTU	5.0	NTU
CONDUCTIVITY	469.	US/CM		US/CM
=TDS AS RESIDUE	406.88	MG/L		
=HARD AS CACO3	21.462	MG/L	200.	MG/L
CALCIUM AS CA	7.54	MG/L	200.	MG/L
MAGNESIUM AS MG	.640	MG/L	150.	MG/L
SODIUM AS NA	96.2	MG/L	270.	MG/L
POTASSIUM AS K	.682	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	80.	MG/L	500.	MG/L
FLUORIDE AS F	.23	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	L.05	MG/L	0.3	MG/L
MANGANESE AS MN	L.01	MG/L	0.05	MG/L
COPPER AS CU	.052	MG/L	1.0	MG/L
ZINC AS ZN	L.01	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		
ALKALINITY,PHENOL AS CACO3	1.235	MG/L		MG/L

REMARKS: Sample #17

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
2

LAB NO: 19G

FIELD NUMBER:
938705510

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16/12/87
TIME: 1030 hours

FIELD NUMBER: 938705509

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.505	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	209.8	MG/L	30 TO 500	MG/L
TURBIDITY	*13.5	NTU	5.0	NTU
CONDUCTIVITY	578.	US/CM		US/CM
=TDS AS RESIDUE	488.22	MG/L		
=HARD AS CACO3	*290.592	MG/L	200.	MG/L
CALCIUM AS CA	105.	MG/L	200.	MG/L
MAGNESIUM AS MG	6.90	MG/L	150.	MG/L
SODIUM AS NA	7.06	MG/L	270.	MG/L
POTASSIUM AS K	3.47	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	105.	MG/L	500.	MG/L
FLUORIDE AS F	.14	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	*1.37	MG/L	0.3	MG/L
MANGANESE AS MN	*1.10	MG/L	0.05	MG/L
COPPER AS CU	L.01	MG/L	1.0	MG/L
ZINC AS ZN	L.01	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
2

LAB NO: 180

FIELD NUMBER:
938705509

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #16

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16 /12 /87
TIME: 1000 hours

FIELD NUMBER: 938705508

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.656	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	233.7	MG/L	30 TO 500	MG/L
TURBIDITY	.6	NTU	5.0	NTU
CONDUCTIVITY	705.	US/CM		US/CM
=TDS AS RESIDUE	676.992	MG/L		
=HARD AS CACO3	*219.679	MG/L	200.	MG/L
CALCIUM AS CA	82.8	MG/L	200.	MG/L
MAGNESIUM AS MG	3.14	MG/L	150.	MG/L
SODIUM AS NA	62.5	MG/L	270.	MG/L
POTASSIUM AS K	2.54	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	236.	MG/L	500.	MG/L
FLUORIDE AS F	.23	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	.03	MG/L	10.	MG/L
IRON AS FE	.100	MG/L	0.3	MG/L
MANGANESE AS MN	*.202	MG/L	0.05	MG/L
COPPER AS CU	L.01	MG/L	1.0	MG/L
ZINC AS ZN	L.01	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
Z

LAB NO: 170

FIELD NUMBER:
938705508

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #15

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR

PHONE #:

DATE: 16 /12 /87
TIME: 1300 hours

FIELD NUMBER: 938705514

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.810	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	250.0	MG/L	30 TO 500	MG/L
TURBIDITY	.5	NTU	5.0	NTU
CONDUCTIVITY	1146.	US/CM		US/CM
=TDS AS RESIDUE	932.644	MG/L		
=HARD AS CACO3	*320.391	MG/L	200.	MG/L
CALCIUM AS CA	117.	MG/L	200.	MG/L
MAGNESIUM AS MG	6.86	MG/L	150.	MG/L
SODIUM AS NA	131.	MG/L	270.	MG/L
POTASSIUM AS K	1.99	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	366.	MG/L	500.	MG/L
FLUORIDE AS F	.80	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	.057	MG/L	0.3	MG/L
MANGANESE AS MN	L.01	MG/L	0.05	MG/L
COPPER AS CU	L.01	MG/L	1.0	MG/L
ZINC AS ZN	3.09	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
7

LAB NO: 230

FIELD NUMBER:
938705514

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #21

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16 /12 /87
TIME: 1330 hours

FIELD NUMBER: 938705515

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	8.011	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	140.2	MG/L	30 TO 500	MG/L
TURBIDITY	.2	NTU	5.0	NTU
CONDUCTIVITY	323.	US/CM		US/CM
*TDS AS RESIDUE	269.83	MG/L		
*HARD AS CACO3	105.379	MG/L	200.	MG/L
CALCIUM AS CA	33.2	MG/L	200.	MG/L
MAGNESIUM AS MG	5.46	MG/L	150.	MG/L
SODIUM AS NA	23.7	MG/L	270.	MG/L
POTASSIUM AS K	.722	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	30.8	MG/L	500.	MG/L
FLUORIDE AS F	.14	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	L.05	MG/L	0.3	MG/L
MANGANESE AS MN	.038	MG/L	0.05	MG/L
COPPER AS CU	L.01	MG/L	1.0	MG/L
ZINC AS ZN	L.01	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
ZL.

LAB NO: 240

FIELD NUMBER:
938705515

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample # 26

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME
ADDR

PHONE #:

DATE: 16 / 12 / 87
TIME: 1400 hours

FIELD NUMBER: 938705516

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.883	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	141.0	MG/L	30 TO 500	MG/L
TURBIDITY	1.1	NTU	5.0	NTU
CONDUCTIVITY	332.	US/CM		US/CM
=TDS AS RESIDUE	260.083	MG/L		
=HARD AS CACO3	136.971	MG/L	200.	MG/L
CALCIUM AS CA	49.1	MG/L	200.	MG/L
MAGNESIUM AS MG	3.49	MG/L	150.	MG/L
SODIUM AS NA	3.25	MG/L	270.	MG/L
POTASSIUM AS K	2.62	MG/L		MG/L
CHLORIDE AS CL	13.1	MG/L	250.	MG/L
SULFATE AS SO4	16.6	MG/L	500.	MG/L
FLUORIDE AS F	.17	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	.122	MG/L	0.3	MG/L
MANGANESE AS MN	*.094	MG/L	0.05	MG/L
COPPER AS CU	L.01	MG/L	1.0	MG/L
ZINC AS ZN	L.01	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:

LAB NO: 25G

FIELD NUMBER:
938705516

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #23

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME
ADDR

PHONE #:

DATE: 16 / 12 / 87
TIME: 1430 hours

FIELD NUMBER: 938705517

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.682	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	242.4	MG/L	30 TO 500	MG/L
TURBIDITY	1.3	NTU	5.0	NTU
CONDUCTIVITY	624.	US/CM		US/CM
*TDS AS RESIDUE	529.203	MG/L		
*HARD AS CACO3	*204.74	MG/L	200.	MG/L
CALCIUM AS CA	73.8	MG/L	200.	MG/L
MAGNESIUM AS MG	4.97	MG/L	150.	MG/L
SODIUM AS NA	40.8	MG/L	270.	MG/L
POTASSIUM AS K	3.06	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	106.	MG/L	500.	MG/L
FLUORIDE AS F	.18	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	.02	MG/L	10.	MG/L
IRON AS FE	.131	MG/L	0.3	MG/L
MANGANESE AS MN	*.084	MG/L	0.05	MG/L
COPPER AS CU	L.01	MG/L	1.0	MG/L
ZINC AS ZN	L.01	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
-

LAB NO: 26G

FIELD NUMBER:
938705517

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample # 24

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16/12/87
TIME: 1500 hours

FIELD NUMBER: 938705518

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.307	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	126.7	MG/L	30 TO 500	MG/L
TURBIDITY	.2	NTU	5.0	NTU
CONDUCTIVITY	422.	US/CM		US/CM
=TDS AS RESIDUE	291.727	MG/L		
=HARD AS CACO3	182.855	MG/L	200.	MG/L
CALCIUM AS CA	63.7	MG/L	200.	MG/L
MAGNESIUM AS MG	5.78	MG/L	150.	MG/L
SODIUM AS NA	5.36	MG/L	270.	MG/L
POTASSIUM AS K	.671	MG/L		MG/L
CHLORIDE AS CL	50.7	MG/L	250.	MG/L
SULFATE AS SO4	8.5	MG/L	500.	MG/L
FLUORIDE AS F	L.10	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	.58	MG/L	10.	MG/L
IRON AS FE	L.05	MG/L	0.3	MG/L
MANGANESE AS MN	L.01	MG/L	0.05	MG/L
COPPER AS CU	L.01	MG/L	1.0	MG/L
ZINC AS ZN	L.01	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:

LAB NO: 270

FIELD NUMBER:
938705518

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #25

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16/12/87
TIME: 1530hours

FIELD NUMBER: 938705519

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.174	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	247.5	MG/L	30 TO 500	MG/L
TURBIDITY	4.3	NTU	5.0	NTU
CONDUCTIVITY	997.	US/CM		US/CM
=TDS AS RESIDUE	852.244	MG/L		
=HARD AS CACO3	*521.417	MG/L	200.	MG/L
CALCIUM AS CA	192.	MG/L	200.	MG/L
MAGNESIUM AS MG	10.2	MG/L	150.	MG/L
SODIUM AS NA	13.7	MG/L	270.	MG/L
POTASSIUM AS K	6.42	MG/L		MG/L
CHLORIDE AS CL	10.0	MG/L	250.	MG/L
SULFATE AS SO4	318.	MG/L	500.	MG/L
FLUORIDE AS F	.10	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	.05	MG/L	10.	MG/L
IRON AS FE	*.561	MG/L	0.3	MG/L
MANGANESE AS MN	*.749	MG/L	0.05	MG/L
COPPER AS CU	L.01	MG/L	1.0	MG/L
ZINC AS ZN	.022	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:

LAB NO: 28G

FIELD NUMBER:
938705519

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample # 26

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16 / 12 / 87
TIME: 1600 hours

FIELD NUMBER: 938705520

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	6.894	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	69.13	MG/L	30 TO 500	MG/L
TURBIDITY	*17.9	NTU	5.0	NTU
CONDUCTIVITY	326.	US/CM		US/CM
=TDS AS RESIDUE	197.761	MG/L		
=HARD AS CACO3	121.94	MG/L	200.	MG/L
CALCIUM AS CA	38.2	MG/L	200.	MG/L
MAGNESIUM AS MG	6.45	MG/L	150.	MG/L
SODIUM AS NA	6.85	MG/L	270.	MG/L
POTASSIUM AS K	1.96	MG/L		MG/L
CHLORIDE AS CL	52.0	MG/L	250.	MG/L
SULFATE AS SO4	7.5	MG/L	500.	MG/L
FLUORIDE AS F	.11	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	.12	MG/L	10.	MG/L
IRON AS FE	*1.71	MG/L	0.3	MG/L
MANGANESE AS MN	*.790	MG/L	0.05	MG/L
COPPER AS CU	.045	MG/L	1.0	MG/L
ZINC AS ZN	L.01	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:

LAB NO: 29G

FIELD NUMBER:
938705520

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #27

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME
ADDR

PHONE #:

DATE: 16 / 12 / 87
TIME: 1630 hours

FIELD NUMBER: 938705521

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.508	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	244.5	MG/L	30 TO 500	MG/L
TURBIDITY	*5.9	NTU	5.0	NTU
CONDUCTIVITY	558.	US/CM		US/CM
=TDS AS RESIDUE	508.329	MG/L		
=HARD AS CACO3	*274.251	MG/L	200.	MG/L
CALCIUM AS CA	95.9	MG/L	200.	MG/L
MAGNESIUM AS MG	8.45	MG/L	150.	MG/L
SODIUM AS NA	9.85	MG/L	270.	MG/L
POTASSIUM AS K	3.04	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	88.	MG/L	500.	MG/L
FLUORIDE AS F	.10	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	.070	MG/L	0.3	MG/L
MANGANESE AS MN	*.067	MG/L	0.05	MG/L
COPPER AS CU	.088	MG/L	1.0	MG/L
ZINC AS ZN	*7.84	MG/L	5.0	MG/L
PB-GF	6.6	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
7

LAB NO: 300

FIELD NUMBER:
938705521

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #23

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16 /12 /87
TIME: 1700hours

FIELD NUMBER: 938704422

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	6.999	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	158.8	MG/L	30 TO 500	MG/L
TURBIDITY	.3	NTU	5.0	NTU
CONDUCTIVITY	443.	US/CM		US/CM
=TDS AS RESIDUE	320.852	MG/L		
=HARD AS CACO3	153.02	MG/L	200.	MG/L
CALCIUM AS CA	51.9	MG/L	200.	MG/L
MAGNESIUM AS MG	5.69	MG/L	150.	MG/L
SODIUM AS NA	14.6	MG/L	270.	MG/L
POTASSIUM AS K	.859	MG/L		MG/L
CHLORIDE AS CL	40.1	MG/L	250.	MG/L
SULFATE AS SO4	8.5	MG/L	500.	MG/L
FLUORIDE AS F	L.10	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	1.27	MG/L	10.	MG/L
IRON AS FE	•1.01	MG/L	0.3	MG/L
MANGANESE AS MN	•.528	MG/L	0.05	MG/L
COPPER AS CU	.047	MG/L	1.0	MG/L
ZINC AS ZN	.131	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		
NITRITE AS N	L.01	MG/L	1.0	MG/L

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
2

LAB NO: 31G

FIELD NUMBER:
938704422

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sampl. #27

• INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16/12/87
TIME: 1730 hours

FIELD NUMBER: 938705523

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.361	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	272.1	MG/L	30 TO 500	MG/L
TURBIDITY	3.5	NTU	5.0	NTU
CONDUCTIVITY	771.	US/CM		US/CM
=TDS AS RESIDUE	664.346	MG/L		
=HARD AS CACO3	*374.121	MG/L	200.	MG/L
CALCIUM AS CA	134.	MG/L	200.	MG/L
MAGNESIUM AS MG	9.60	MG/L	150.	MG/L
SODIUM AS NA	19.4	MG/L	270.	MG/L
POTASSIUM AS K	3.48	MG/L		MG/L
CHLORIDE AS CL	L5.	MG/L	250.	MG/L
SULFATE AS SO4	161.	MG/L	500.	MG/L
FLUORIDE AS F	L.10	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	.04	MG/L	10.	MG/L
IRON AS FE	*1.58	MG/L	0.3	MG/L
MANGANESE AS MN	*.316	MG/L	0.05	MG/L
COPPER AS CU	.010	MG/L	1.0	MG/L
ZINC AS ZN	L.01	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:

LAB NO: 32G

FIELD NUMBER:
938705523

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #50

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16/12/87
TIME: 1800hours

FIELD NUMBER: 938705524

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.573	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	135.5	MG/L	30 TO 500	MG/L
TURBIDITY	.9	NTU	5.0	NTU
CONDUCTIVITY	440.	US/CM		US/CM
=TDS AS RESIDUE	310.338	MG/L		
=HARD AS CACO3	151.694	MG/L	200.	MG/L
CALCIUM AS CA	53.1	MG/L	200.	MG/L
MAGNESIUM AS MG	4.64	MG/L	150.	MG/L
SODIUM AS NA	14.7	MG/L	270.	MG/L
POTASSIUM AS K	2.08	MG/L		MG/L
CHLORIDE AS CL	44.1	MG/L	250.	MG/L
SULFATE AS SO4	26.5	MG/L	500.	MG/L
FLUORIDE AS F	L.10	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	.097	MG/L	0.3	MG/L
MANGANESE AS MN	*.106	MG/L	0.05	MG/L
COPPER AS CU	.017	MG/L	1.0	MG/L
ZINC AS ZN	.013	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:

LAB NO: 33G

FIELD NUMBER:
938705524

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #51

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16/12/87
TIME: 1830 hours

FIELD NUMBER: 938705525

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.086	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	128.1	MG/L	30 TO 500	MG/L
TURBIDITY	.3	NTU	5.0	NTU
CONDUCTIVITY	496.	US/CM		US/CM
*TDS AS RESIDUE	324.539	MG/L		
*HARD AS CACO3	143.06	MG/L	200.	MG/L
CALCIUM AS CA	47.4	MG/L	200.	MG/L
MAGNESIUM AS MG	6.00	MG/L	150.	MG/L
SODIUM AS NA	27.0	MG/L	270.	MG/L
POTASSIUM AS K	2.01	MG/L		MG/L
CHLORIDE AS CL	64.5	MG/L	250.	MG/L
SULFATE AS SO4	20.9	MG/L	500.	MG/L
FLUORIDE AS F	L.10	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	.13	MG/L	10.	MG/L
IRON AS FE	L.05	MG/L	0.3	MG/L
MANGANESE AS MN	L.01	MG/L	0.05	MG/L
COPPER AS CU	.018	MG/L	1.0	MG/L
ZINC AS ZN	L.01	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUPPLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:

LAB NO: 340

FIELD NUMBER:
938705525

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample # 22

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16 /12 /87
TIME: 1900 hours

FIELD NUMBER: 938705526

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.240	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	164.1	MG/L	30 TO 500	MG/L
TURBIDITY	.3	NTU	5.0	NTU
CONDUCTIVITY	584.	US/CM		US/CM
=TDS AS RESIDUE	439.392	MG/L		
=HARD AS CACO3	*230.611	MG/L	200.	MG/L
CALCIUM AS CA	79.0	MG/L	200.	MG/L
MAGNESIUM AS MG	8.10	MG/L	150.	MG/L
SODIUM AS NA	8.63	MG/L	270.	MG/L
POTASSIUM AS K	3.18	MG/L		MG/L
CHLORIDE AS CL	23.4	MG/L	250.	MG/L
SULFATE AS SO4	117.	MG/L	500.	MG/L
FLUORIDE AS F	L.10	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	.057	MG/L	0.3	MG/L
MANGANESE AS MN	*.999	MG/L	0.05	MG/L
COPPER AS CU	L.01	MG/L	1.0	MG/L
ZINC AS ZN	L.01	MG/L	5.0	MG/L
PB-GF	L2.0	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:

LAB NO: 35G

FIELD NUMBER:
938705526

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #35

* INDICATES GREATER THAN ACCEPTABLE LIMIT

DEPT. OF MUNICIPAL AFFAIRS AND ENVIRONMENT WELL WATER CHEMISTRY REPORT

NAME:
ADDR:

PHONE #:

DATE: 16 / 12 / 87
TIME: 1930 hours

FIELD NUMBER: 938705527

L MEANS LESS THAN
G MEANS GREATER THAN
A MEANS APPROXIMATE

CHEMICAL TEST	YOUR WELL RESULTS	YOUR WELL UNITS	MAXIMUM ACCEPTABLE LIMITS CONCENTRATION	MAXIMUM ACCEPTABLE LIMITS UNITS
PH	7.416	PHUNITS	6.5 TO 8.5	PHUNITS
ALKALINITY,TOTAL AS CACO3	238.7	MG/L	30 TO 500	MG/L
TURBIDITY	*12.0	NTU	5.0	NTU
CONDUCTIVITY	642.	US/CM		US/CM
=TDS AS RESIDUE	545.589	MG/L		
=HARD AS CACO3	*323.697	MG/L	200.	MG/L
CALCIUM AS CA	119.	MG/L	200.	MG/L
MAGNESIUM AS MG	6.45	MG/L	150.	MG/L
SODIUM AS NA	10.2	MG/L	270.	MG/L
POTASSIUM AS K	2.82	MG/L		MG/L
CHLORIDE AS CL	14.1	MG/L	250.	MG/L
SULFATE AS SO4	102.	MG/L	500.	MG/L
FLUORIDE AS F	L.10	MG/L	1.5	MG/L
NITRATE-NITRITE AS N	L.01	MG/L	10.	MG/L
IRON AS FE	*2.36	MG/L	0.3	MG/L
MANGANESE AS MN	*.716	MG/L	0.05	MG/L
COPPER AS CU	.011	MG/L	1.0	MG/L
ZINC AS ZN	.055	MG/L	5.0	MG/L
PB-GF	3.7	UG/L		

PROP NO: 102
EVENT NO: A

PROP NAME:
DOMESTIC WATER SUP
PLY

MANAGER:
GEORGE RICHARD

STATION NUMBER:
-

LAB NO: 36G

FIELD NUMBER:
938705527

DATE DUE: 88 01 18
DATE REC: 88 01 05
DATE FWD: 88 01 13

DAYS TURNAROUND:
7

REMARKS: Sample #34

* INDICATES GREATER THAN ACCEPTABLE LIMIT

APPENDIX B

WATER RESOURCE QUESTIONNAIRE

WATER RESOURCE QUESTIONNAIRE

NAME:

LOT NO:

ADDRESS:

DATE WELL(S) DRILLED:

DO YOU HAVE A WELL LOG (DRILLER REPORT):

NAME OF DRILLER:

AMOUNT OF CASING: FEET

DEPTH OF WELL: FEET

PUMP SETTING/TYPE OF PUMP:

APPROXIMATE WELL YIELD: GALLONS

WHAT PROBLEMS HAVE YOU EXPERIENCED WITH YOUR WATER SUPPLY?

DO YOU USE A WATER TREATMENT SYSTEM? WHAT TYPE?

IS THERE A CHEMICAL TEST AVAILABLE:

HAVE YOU HAD A BACTERIAL TEST ON YOUR WELL WATER?

COMMENTS:

MARITIME GROUNDWATER

WATER RESOURCE STUDY

McLEOD HILL, YORK COUNTY

January, 1988

GEOLOGY AND SAMPLE COLLECTION POINTS

Prepared by :

THREE-D GEOCONSULTANTS LIMITED

and

MARITIME GROUNDWATER INVESTIGATIONS INC.

Prepared for :

WATER RESOURCES PLANNING BRANCH
NEW BRUNSWICK MUNICIPAL AFFAIRS and ENVIRONMENT

\+ *Low yield wells*

● S-26 *Sample collection points and identification number*

Surficial Geology

aAt	*Postglacial valley terraces*
Gb	*Glaciofluvial deposits*
aMm	*Morainal plain*
aMb	*Stoney morainal blanket till*
aMv	*Stoney lodgement till*
Cv	*Colluvium*
— —	*Surficial unit contact (approximate)*

Bedrock Geology

P_3	*Pictou Group*
P_1	*Boss Point Formation*
MPmv	*Mississippian / Pennsylvanian Unit volcanics*
MPs	*Mississippian / Pennsylvanian Unit sediments*
.....	*Bedrock unit contact (assumed)*
~ ~ ~	*Fault (assumed)*

Note : Lack of control points makes it impossible to confirm, in detail, the stratigraphic column or to locate contacts and faults with any degree of accuracy

SCALE 1" = 1/4 mile

1000 0 1000 2000 3000 4000 Feet

West

COLLECTION POINTS

for :

TER RESOURCES PLANNING BRANCH
W BRUNSWICK MUNICIPAL AFFAIRS
ENVIRONMENT

umber

ock Geology

P_3	*Pictou Group*
P_1	*Boss Point Formation*
^{P}mv	*Mississippian / Pennsylvanian Unit volcanics*
Ps	*Mississippian / Pennsylvanian Unit sediments*
.....	*Bedrock unit contact (assumed)*
~ ~	*Fault (assumed)*

te : Lack of control points makes it impossible to confirm, in detail, the stratigraphic column or to locate contacts and faults with any degree of accuracy

4 mile

00 3000 4000 Feet

ROY

aMv

Sams
Lake
aMm
P3

oints makes it impossible to
il, the stratigraphic column
tacts and faults with any
acy

0 Feet

aMv P3 S-6 620 Nashwaaksis P3

Mill Brook

Kingsley Road S-3

S-5 ROYAL ROAD S-13 Stream

aMv

Stream

aMv aAt Branch Nashwaaksis

North

S-4 S-2 S-1

aMv

S-19 S-34 S-33 S-26 S-32 S-31 S-30 S-28 S-20 S-21 S-18 S-29 S-17 S-24 S-15 S-14 S-16 S-27 S-25 S-22 S-10 S-23

aMb

McLEOD HILL

Nashwaaksis

aAt

P3

McLeod Hill Road

N.B.E.P.C.

aMv

MPs Cv MPmv P1? (MPs?)

S-11 S-8

Stream

City Limits

Fredericton

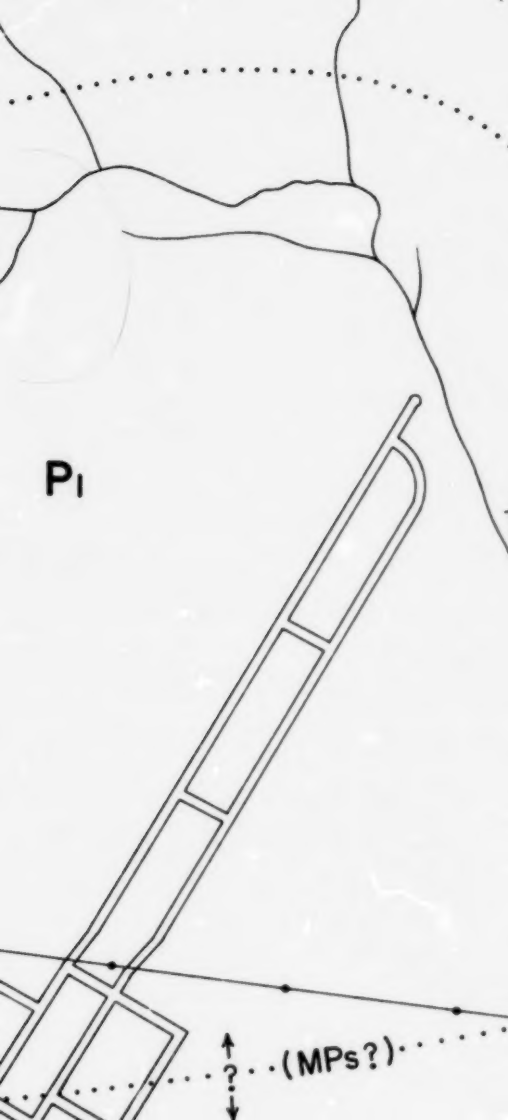
aMb

S-9

aMv aAt S-12 Gb P3

N.B.E.P.C.

Douglas Parish


P1
?
(MPs?)